

**SECTION 22 61 13.74  
DENTAL COMPRESSED-AIR PIPING**

SPEC WRITER NOTES:

1. Delete between // // if not applicable to project. Also delete any other item or paragraph not applicable in the Section and renumber the paragraphs.
2. References to pressure in this section are gauge pressure unless otherwise noted.
3. Edit for 965 kPa (140 psig) system or 689 kPa (100 psig) system. See VA Plumbing Design Manual for air pressures required.
4. For sedation dentistry piping include Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES and Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES.

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section describes the requirements for central dental compressed air piping, including all necessary piping, fittings, valves, cabinets, outlets, gauges, and low voltage wiring from pressure switch to alarm.
- B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- D. //Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//
- E. Section 07 84 00, FIRESTOPPING: Sealing around pipe penetrations to maintain the integrity of time rated construction.
- F. Section 07 92 00, JOINT SEALANTS: Sealing around pipe penetrations through the floor to prevent moisture migration.
- G. //Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic Restraint.//
- H. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- I. //Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//
- J. Section 22 61 19.74, DENTAL COMPRESSED-AIR EQUIPMENT: Air source equipment.

K. Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES. Vacuum Piping and Equipment.

L. Section 22 63 00, GAS SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES: Ceiling outlets, hose drops and valve cabinets.

**1.3 APPLICABLE PUBLICATIONS**

SPEC WRITER NOTE: Make material requirements agree with requirements specified in the referenced Applicable Publications. Verify and update the publication list to that which applies to the project, unless the reference applies to all plumbing systems. Publications that apply to all plumbing systems may not be specifically referenced in the body of the specification but shall form a part of this specification.

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.
- B. American Society of Mechanical Engineers (ASME):
  - ASME Boiler and Pressure Vessel Code -
  - BPVC Section IX-2019....Welding, Brazing, and Fusing Qualifications
  - A13.1-2015.....Scheme for the Identification of Piping Systems
  - B16.3-2016.....Malleable Iron Threaded Fittings: Classes 150 and 300
  - B16.22-2018.....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings
  - B16.50-2018.....Wrought Copper and Coper Alloy Braze-Joint Pressure Fittings
  - B40.100-2013.....Pressure Gauges and Gauge Attachments
- C. American Society of Sanitary Engineering (ASSE):
  - 6000-2018.....Professional Qualifications Standard for Medical Gas Systems Personnel
  - 6010-2018.....Medical Gas Systems Installers
  - 6020-2018.....Medical Gas Systems Inspectors
  - 6030-2018.....Medical Gas Systems Verifiers
- D. American Society for Testing and Materials (ASTM):
  - A47/A47M-1999(R2018)e1..Standard Specification for Ferritic Malleable Iron Castings

- A53/A53M-2018.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- A536-1984 (R2019)e1.....Standard Specification for Ductile Iron Castings
- B819-2019.....Standard Specification for Seamless Copper Tube for Medical Gas Systems
- F2063-2018.....Standard Specification for Wrought Nickel-Titanium Shape Memory Alloys for Medical Devices and Surgical Implants
- E. American Welding Society (AWS):
- A5.8M/A5.8-2019.....Specification for Filler Metals for Brazing and Braze Welding
- B2.2/B2.2M-2016.....Specification for Brazing Procedure and Performance Qualifications
- F. Compressed Gas Association (CGA):
- C-9-2019.....Standard Color Marking of Compressed Gas Containers for Medical Use
- G-4.1-2018.....Cleaning Equipment for Oxygen Service
- G-10.1-2016.....Commodity Specification for Nitrogen
- P-9-2015.....The Inert Gases: Argon, Nitrogen and Helium
- V-1-2019.....Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections
- V-5-2019.....Standard for Diameter Index Safety System (Noninterchangeable Low Pressure Connections for Medical Gas Applications)
- G. International Code Council (ICC):
- IPC-2018.....International Plumbing Code
- H. Manufacturing Standardization Society: (MSS)
- SP-72-2010a.....Ball Valves with Flanged or Butt-Welding Ends for General Service
- SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
- I. National Fire Protection Association (NFPA):
- 70-2020.....National Electrical Code (NEC)
- 99-2018.....Health Care Facilities Code
- J. Department of Veterans Affairs (VA):
- PG-18-10.....Plumbing Design Manual

**1.4 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 61 13.74, DENTAL COMPRESSED-AIR PIPING", with applicable paragraph identification.
- C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
  - 1. Piping and fittings.
  - 2. Valves.
  - 3. Zone valve box.
  - 4. Outlets.
  - 5. Gauges.
  - 6. Switches (pressure).
  - 7. Alarm components.
- D. Station Outlets and Inlets: A letter shall be submitted from manufacturer stating that outlets and inlets are designed, manufactured, and shall comply with NFPA 99. Outlets and inlets shall bear label of approval as assembly of Underwriters Laboratories, Inc. or Associated Factory Mutual Research Corporation. In lieu of above labels, certificate may be submitted by a nationally recognized independent testing laboratory, satisfactory to the Contracting Officer Representative (COR), certifying that materials, appliances and assemblies conform to published standards, including methods of tests, of above organizations.
- E. Certification: The completed systems shall be certified having been installed, tested, purged and analyzed in accordance with the requirements of this specification and NFPA 99.
- F. Qualification of the Installer: Provide the name and copy of the ASSE qualifications of each person completing the installation.
- G. Certification that all results of tests are within limits specified.
- H. Provide testing agency qualifications, including names and qualifications of each person completing the testing, detailed testing procedures, and references from three completed projects involving similar scope.

SPEC WRITER NOTE: Coordinate O&M Manual and commissioning requirements with Section 01 00 00, GENERAL REQUIREMENTS and Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS. O&M Manuals shall be submitted for content review as part of closeout documents.

- I. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:
  - 1. Include complete list indicating all components of the systems.
  - 2. Include complete diagrams of the internal wiring for each item of equipment.
  - 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
- J. //Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//
- K. //Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

#### **1.5 QUALITY ASSURANCE**

- A. Installer qualifications shall meet those qualifications stated in ASSE 6010.
- B. Medical Gas System Testing Organization:
  - 1. The testing shall be conducted by a party technically competent and experienced in the field of medical gas pipeline testing. Such testing shall be performed by a party other than the installing contractor.
  - 2. The testing personnel shall be qualified according to ASSE 6020 for inspectors and ASSE 6030 for verifiers.
  - 3. Names of three projects where testing of medical gas systems has been performed shall be submitted by the testing agency for review. The list of three references shall include the name of the project, names of such persons at that project who supervised the work for the project owner, or who accepted the report for the project owner, and a written statement that the projects listed required work of similar scope to that set forth in this specification.

4. The testing agency's detailed procedure to be followed in the testing of this project shall be submitted. These procedures shall be in compliance with current NFPA standards and shall include details of the testing sequence, procedures for cross connection tests, outlet function tests, alarm tests, and purity tests, as required by NFPA 99. Data on test methods, types of equipment to be used, and calibration sources and method references for purity tests procedures shall be submitted.
- C. Brazing process and operators shall be qualified according to ASME BPVC Section IX or AWS B2.2/B2.2M.
- D. The electrical devices and accessories shall be listed and labeled as defined in NFPA 70 by a testing agency and marked for its intended use.
- E. All work shall comply with NFPA 99.
- F. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <https://www.biopreferred.gov>.
- G. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

#### **1.6 AS-BUILT DOCUMENTATION**

- A. Comply with requirements in Paragraph AS-BUILT DOCUMENTATION of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

#### **1.7 PROJECT CONDITIONS**

- A. Interruption of existing medical air systems shall not be made without the coordination of the VAMC. The VAMC shall be notified 14 days in advance of proposed interruption. The interruption shall not be made without the written permission from the VAMC.

### **PART 2 - PRODUCTS**

#### **2.1 PIPING**

- A. Copper medical gas tube shall be Type K or L, seamless, drawn temper meeting ASTM B819 that has been cleaned, purged, and sealed for medical gas service by the pipe manufacturer. Standard color markings "ACR/MED" shall be in green for Type K and in blue for Type L tubing.
- B. Wrought copper fittings shall be solder joint complying with ASME B16.22, dimensions for brazed joints complying with ASME B16.50.

- C. Brazing filler Metals shall be BCuP series, copper-phosphorus with a melting temperature greater than 538 deg C (1000 deg F) allows for general duty brazing conforming to AWS A5.8M/A5.8. Flux shall be strictly prohibited for copper to copper connections.
- D. Screw Joints shall be made with degreased polytetrafluoroethylene (Teflon) tape.
- E. Piping identification labels shall be applied at time of installation in accordance with NFPA 99. Supplementary color identification shall be in accordance with //CGA C-9// //or// //ASME A13.1//.
- F. Temperature and pressure ratings of memory metal couplings shall be not less than that of a brazed joint shall be permitted. The memory metal couplings shall be made of ASTM F2063, nickel titanium, shape memory alloy, cleaned, purged, and sealed for medical gas service.

## 2.2 VALVES

- A. Valves shall be cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.
- B. Ball valves: Ball valves shall be inline, other than zone valves in cabinets.
  - 1. 100 mm or DN100 (NPS 4 inches) and smaller: Ball valves shall be bronze/brass body, MSS SP-72 and MSS SP-110, Type II, Class 150, Style 1, shall be full port, three-piece or double union end connection, double seal, chrome plated brass with PTFE or TGFE seats, lever type handle with locking device, blowout proof stem with PTFE or TFE seal and ends manufactured according to ASTM B819 with copper tube extensions for brazed connections. The ball valve shall have a pressure rating of 4138 kPa (600 psig) WOG maximum working pressure.
- C. Check valves:
  - 1. 75 mm or DN80 (NPS 3 inches) and smaller: Check valves shall be brass /bronze body, straight through design for minimum pressure drop, spring loaded, self-aligning with Teflon cone seat, vibration free, silent operation, with ends manufactured according to ASTM B819 with copper tube extensions. Check valves shall have directional arrow permanently cast into body. The check valve shall have a pressure rating of 2758 kPa (400 psig) WOG maximum working pressure.
- D. Zone valves shall be three-piece body, brass or bronze full port, chrome plated brass ball valve with, double seal, three-piece or double

union end connections, gauge with replaceable PTFE or TGFE seats, lever type handle with locking device, blowout proof stem with PTFE or TFE seal and ends manufactured according to ASTM B819 with copper tube extensions. The ball valve shall have a pressure rating of 4138 kPa (600 psig) WOG maximum working pressure. A 3.2 mm (1/8 inch) NPT gauge port shall be provided for a 50 mm (2 inch) diameter monitoring gauge downstream of the shut-off valve. A quarter turn lockable handle shall be required to completely open to closed position. Zone valves shall be securely attached to the cabinet and provided with Type K copper tube extensions for making connection to system piping outside the cabinet.

SPEC WRITER NOTE: Select single or multiple non-sensor or sensor zone indicator panel.

### **2.3 ZONE VALVE BOXES**

- A. Zone Valve boxes shall be formed steel with anchors for recessed mounted and includes holes with grommets in the box sides for tubing extension protection. The zone valve box shall be of the size for single or multiple valves as indicated with pressure gauges//, sensors,// and space for manual operation of valves. Gauges shall be visible through the door. A quarter turn handle shall be required for open to close position. The switch shall be wired //normally open// //normally closed//, 6 mm (1/4 inch) FNPT connection and fitted with a quick connect to facilitate field service. Electrical rating 10 amperes at 120-volt AC.
- B. The interior finish shall be factory applied baked white enamel.
- C. The frame assembly shall be anodized aluminum and frangible or removable windows. The valve box windows shall be replaceable clear or tinted transparent plastic with labeling that includes rooms served according to NFPA 99.

### **2.4 OUTLETS**

- A. The outlet shall be for specific medical/dental compressed air pressure and service listed. Rough-in assemblies shall be included. Recessed units shall be provided unless indicated. Outlets shall be UL listed, CSA certified.
- B. Finish assembly shall include primary check valve and secondary check valve rated at maximum 1380 kPa (200 psig), double seals to prevent air leakage and cover plate with service label.



- C. Quick coupler service connections shall include a pressure outlet with non-interchangeable keyed indexing and constructed to permit one-handed connection and removal of equipment using a positive locking ring that retains the equipment stem in valve during use.
- D. DISS service connection outlets shall comply with CGA V-5 with threaded indexing constructed to permit one handed connection and removal of equipment.

## **2.5 GAUGES, PRESSURE**

- A. Pressure gauges used for testing purposes shall be listed for dental compressed air and conform to ASME B40.100.
- B. Pressure gauges for line pressure use adjacent to source equipment shall be 114 mm (4-1/2 inch) diameter, accuracy to within 2 percent. The pressure range shall be twice the operating pressure. Dial graduations and figures shall be black on white background. Gauge shall be cleaned and listed for oxygen use and marked "USE NO OIL". The pressure gauge shall comply with ASME B40.100 and have a gauge cock and marked "USE NO OIL". Install with gauge cock.
- C. For all services downstream of main shutoff valve, the pressure gauges shall be manufactured expressly for oxygen use but labeled for dental air service and marked "USE NO OIL", 38 mm (1-1/2 inch) diameter gauge with dial range 1 to 2070 kPa (1 to 300 psig).

SPEC WRITER NOTE: Coordinate and assure that the electrical characteristics specified below are clearly shown on appropriate drawings. Coordinate with Electrical Engineer.

## **2.6 //PRESSURE SWITCH**

- A. Pressure switches and sensors shall be UL listed and shall be NEMA Type 4 watertight housing field adjustable pressure settings. The switch shall be wired //normally open// //normally closed//, 6 mm (1/4 inch) FNPT connection and fitted with a quick connect to facilitate field service. Electrical rating 10 amperes at 120-volt AC.//

## **2.7 ALARM COMPONENTS**

- A. //Digital LCD// //Compact Digital Alarm// Category 3 Alarm System shall be microprocessor based with //a 25.4 cm (10 inch) screen// //with individual microprocessors on each display and sensor board// and capable of monitoring up to 8 sensors. Sensors shall be //mounted locally (in the rough-in box) by installing the copper pipe provided// //mounted remotely//. Sensors will be automated for gas specific

detection. Each sensor shall be gas specific and an error message shall be displayed for an incorrect connection located within the area of use that provides a continuous visible and audible surveillance of Category per NFPA 99.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. All dental air tube and fittings, valves, gauges, and other components shall be free of oil, grease, and other readily oxidizable materials as required according to CGA G-4.1.
- B. All dental air tube and components shall be cleaned and capped for oxygen service in a facility equipped to clean, rinse and purge the material in accordance with Category 3 piping per NFPA 99.

#### **3.2 INSTALLATION**

- A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.
- B. Pipe, fitting, and component installation shall conform to NFPA 99 5.1.10.4. Brazing shall be performed only by brazers qualified under NFPA 99 5.1.10.11.10. Where piping runs underground, the installation shall be made in accordance with NFPA 99 5.1.10.11.5.
- C. New pipe to existing pipe connections shall be connected with memory metal couplings.
- D. Dental air piping shall use either Type L or K, copper medical gas tube, wrought copper fittings, and brazed joints.
- E. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING, shall be used for pipe penetrations and sleeves.
- F. Pipe installation shall comply with ASSE 6010.
- G. All piping shall be installed parallel or at right angles to building walls.
- H. Piping above ceilings shall be installed to allow for the removal of ceiling tiles.
- I. Air and drain piping shall be installed at a one percent slope.
- J. Nipples, unions, special fittings shall be installed with pressure ratings same as or higher than system pressure rating.
- K. Eccentric reduces shall be used when dental air piping is reduced in the direction of flow with bottoms of both pipes and reduced fitting flush with bottom of pipe.
- L. Branch connections shall be installed from the top of the main.

- M. Pressure gauges shall be installed on discharge piping from each compressor and on each receiver.
- N. //Seismic restraints shall be installed as required by the location and Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.//
- O. Open ends of tube shall be capped or plugged at all times or otherwise sealed until final assembly.
- P. Piping shall be cut square and accurately with a tube cutter (sawing is prohibited) to measurements determined at place of installation. Pipe shall be reamed to remove burrs, being careful not to expand tube, and so no chips of copper remain in the tube. Piping shall be worked into place without springing or forcing. Tube shall be bottomed in socket so there are no gaps between tube and fitting. Care shall be exercised in handling equipment and tools used in cutting or reaming of tube to prevent oil or grease being introduced into tubing. Where contamination has occurred, material shall be no longer suitable for dental air service.
- Q. Spacing of Hangers shall comply with NFPA 99. Refer to Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING for additional hanger requirements.
- R. Valves and other equipment shall be rigidly supported to prevent strain on tube or joints.
- S. Install unions in piping adjacent to each valve and connection to equipment and each specialty.
- T. While being brazed, joints shall be continuously purged with oil-free dry nitrogen complying with NFPA 99. The flow of purge gas shall be maintained until joint is cool to the touch.
- U. Pipe fittings shall be used for all changes in direction. Tube shall not be bent or forced into place.
- V. Support ceiling column assembly from heavy sub-mounting castings furnished with the unit as part of roughing-in. The ceiling column assembly shall be anchored with 13 mm (1/2 inch) diameter bolts attached to angle iron frame supported from structural ceiling, unless otherwise indicated.
- W. Pressures and vacuum switches, transmitters, and gauges shall be installed to be easily accessed, and provide access panel where installed above plaster ceiling. Pressure switches and sensors shall be installed for gas specified with gas specific demand check fittings.

- X. Pipe labeling shall be applied during installation process and not after installation is completed. The size of legend letters shall be in accordance with ASME A13.1.
- Y. After initial leakage testing is completed, allow piping to remain pressurized with testing gas until testing agency performs final tests.
- Z. Penetrations:
  - 1. Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a firestop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the firestopping material.
  - 2. At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS.
- AA. Install flexible pipe connector is discharge piping from each compressor.
- BB. Install shut-off valve to each connection to and from air compressor and manifolds, and specialties.

### **3.3 STARTUP AND TESTS**

- A. Initial blow down, initial pressure test for positive-pressure gas systems and copper Category 3 vacuum piping, initial cross-connection test, initial piping purge test, and initial standing positive-pressure gas piping tests shall be conducted for a Category 3 compressed air system as required by NFPA 99. All test results shall be documented and submitted to the COR.
- B. Verifier standing pressure test, verifier cross-connection test, verifier Category 3 warning system test, verifier piping purge test, verifier final tie-in test, verifier operational pressure test, verifier piping particulate test, verifier piping purity test, labeling, use of source equipment for pipeline verification test, and test of secondary equipment shall be conducted for a Category 3 compressed air system as required by NFPA 99. All test results shall be documented and submitted to the COR.
- C. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

- D. The tests shall include system capacity, control function, and alarm functions.
- E. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.
- F. //The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.//

**3.4 //COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.
- B. Components provided under this section of the specification will be tested as part of a larger system.//

**3.5 DEMONSTRATION AND TRAINING**

- A. Provide services of manufacturer's technical representative for //4//  
// // hour//s// to instruct each VA personnel responsible in operation and maintenance of the system.
- B. //Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

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